

Active agent concentrates – on the benefits of sera and ampoules

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Active agents in concentrated form are a long-burning issue. Which of them are really effective and what can they achieve? Is their concentrated form the decisive factor or rather the carrier substance? Another question is what specific skin conditions can best be treated with concentrates?

Just to say it in advance: the key advantage of active agent concentrates is their ample field of application in the treatments offered by cosmetic institutes. They can be integrated in various types of treatments, either as individual application, as a component of masks or in modular form combined with base components such as creams, gels or lotions; they also can be applied in combination with instrument-based treatments. To start with we should discuss definitions: the term serum originates from medical terminology and initially is used in the context of blood serum or vaccinations. In cosmetic terminology, serum stands either for a solution consisting of an extract or for an individual, comparably concentrated active agent. Hence serum is the synonym for an active agent concentrate.

Convenient doses

Ampoules are a widespread and inexpensive way to sell active agent concentrates alias sera on the market. They mostly consist of glass or various plastics and are designed for short-term or often onetime use of their contents. They usually contain non-preserved aqueous solutions with extended shelf-life provided that they are filled under sterile conditions which cannot always be realised with heat-sensitive active agents. Ampoules are particularly suited for the filling of oxygen-sensitive substances. After opening, the sterile and non-preserved products have to be consumed within a few days even when stored in the refrigerator.

Another option for filling is using pipettes with integrated ml-measuring unit. The potentially allergenic preservatives listed in the annex of the Cosmetic Regulation should be avoided since the active agent concentrates often contain penetration-enhancing substances or a carrier in the form of liposomes (water-soluble active agents) or nanodispersions (fat-soluble or difficultly soluble active agents). The reason behind is that the preservatives find their way into the skin together with the active agents

and in the case of intense treatments they can cause unwanted adverse effects. In contrast to ampoules, pipettes can be used for a longer period of time after opening them.

Cosmeceuticals & Co.

Term and form of ampoules often are linked to medical treatments. As a matter of fact, among the filled active agent concentrates often are cosmeceuticals, a substance group which is bordered between cosmetic and pharmaceutical preparations as the term already insinuates. Since comparisons of numbers are a knock-down argument, sales promotions frequently use statements such as high dosage. Antioxidants or radical scavengers are classics in this context, both widely used thanks to marketing fads like anti-pollution or detox. Vitamin C ampoules are an example here. A derivative of vitamin C, Ascorbyl Phosphate (INCI) in liposomal form, or in other words encapsulated into a penetration-enhancing carrier, by contrast can be mentioned as an excellent example for achieving best results with low-dosed substances. Put another way, consumers should read detailed information and above all reliable technical documentation when using active agent concentrates.

Skin diagnosis

A well-performed skin diagnosis is the prerequisite for effective treatments. It serves as a basis for the selection of particular sera, their specific form and the kind of treatment: in pure and undiluted form after the skin cleansing and before applying the mask, as a component of a mask, as a final application or maybe in modular form for the treatment at home. This treatment at home can be realised in a way that clients buy active agent concentrates and base component at the institute and mix the products at home or use them one after the other. Alternatively the base component is adapted to the personal needs in the institute and this activity is then billed as an individual

service. In the case of modular treatments ("modular system"), substance concentrations usually are lower due to the fact that the active agents are diluted by the base component in a 1:10 ratio.

Instrument-based tools

The use of ultrasound (1-40 MHz), iontophoresis (with negatively charged extracts and anions of acids) radio frequency devices (only monopolar), mesoporation (pulsed electric fields) and medical needling (0.5-3 mm needles) in combination with active agent concentrates requires that device manuals and legal regulations are closely observed. As far as it is a question of penetration-enhancing effects, carriers such as liposomes and nanodispersions almost are equivalent however with less spectacular effects in the daily practice. In ultrasound treatments other effects such as a stimulated microcirculation, tightening of the connective tissue, fat mobilisation (cellulite) are more decisive factors. The perforations of medical needling primarily serve for the regeneration of scar tissue rather than for the permeation of active agents.

Concentrates in their daily use

As a general rule, the treatment objectives can be differentiated into protection, regeneration, anti-aging, complexion and problem skin. It is however more difficult to classify the active agent concentrates since among them are specialists that can clearly be attributed to a single purpose and there are many others with multifunctional features. Also all-rounders can be found among them that can be used for various purposes. It is impossible to set up an order of priority considering their efficacy since the individual skin shows a broad variety of different reactions to the different components. The following overview is not intended to be exhaustive.

Protection

- Besides glycerin and glycols, dry skin is treated with active agent concentrates based on the amino acids of the Natural Moisturizing Factor (NMF) including urea as a moisturising agent, or filming moisturising substances such as hyaluronic acid and algae extracts. Also nanodispersions in combination with encapsulated triglycerides are administered in this case. Amino acids also serve as natural radical scavengers.
- Ceramides, hydrogenated and native phosphatidylcholine with its content of linoleic acid support the skin barrier.

Native phosphatidylcholine not only works as a substrate for the formation of ceramide I that essentially influences the elasticity of the skin, but also acts as a carrier for liposomes and nanodispersions.

- In cases with balanced amino acid content and thus a balanced skin hydration there is no need to administer the frequently propagated antioxidants (see below) for skin protection. Also specific anti-pollution agents become superfluous when the skin barrier is adequately supported.
- CM-Glucan also has a protective function; it stabilises the skin hydration and has a slight erythema-inhibiting effect.

Regeneration

- Vitamin A (retinol) and its esters are the most frequently found active agents among the group of the growth-factor stimulating retinoids. Vitamin A acid is an effective metabolite. The German Federal Institute for Risk Assessment (Bundesinstitut für Risikobewertung – BfR) recommends limiting its use to facial application.
- Vitamins of the B-series, among others contained in yeast extracts, also stimulate the natural growth factors. The most important among them are vitamin B₃ (niacinamide) and provitamin B₅ (D-panthenol) which also has penetration-enhancing features.
- Among the minerals, zinc salts ($\leq 1\%$) have to be mentioned since they serve as a substrate for oxidoreductases, among others for the superoxide dismutase (SOD).
- Essential fatty acids (see problem skin) encapsulated in nanodispersions play an important part.

Anti-Aging

- Also in this case, the antioxidants are overestimated and overdosed. Vitamin C and vitamin E as well as their esters, glutathione, coenzyme Q₁₀ (only effective after reduction in the skin), lipoic acid and polyphenols such as the oligomeric proanthocyanidins (OPC, gained from grape seed extract) or resveratrol are applied for this purpose.
- Hyaluronic acid is broadly represented in different variants due to its superficial plumping effect. An interesting fragment in this context is N-acetylglucosamine that can pass the skin barrier in its liposomal form and thus

stimulate the endogenous hyaluronic acid synthesis that determines the turgor of the skin.

- Collagen stimulants in the form of different peptides or ascorbic acid derivatives and collagenase inhibitors such as boswellic acids still are important ingredients in combination with efficacy-enhancing carriers.
- Spilanthol gained from *para cress* has established as a very effective alternative to the temporarily wrinkle-reducing peptides whose effects are comparable to Botox. Spilanthol belongs to the group of capsaicinoids.
- Skin-tightening extracts for the eye contours and décolleté area are kigelia and centella asiatica, green tea, caffeine and butcher's broom extract.
- Among the vessel stabilising active agents are extracts of butcher's broom, horse chestnut (alias buckeye) and horsetail, tranexamic acid (synthetic).
- To stimulate lipolysis and microcirculation, caffeine, green tea and isoflavonoids are recommended. A prerequisite for a beneficial cellulite treatment are supportive instrument-based or physiotherapeutic measures.
- Isoflavonoids (phytohormones) dock onto the estrogen receptors. They are beneficial for the atrophic skin occurring during menopause and post menopause.
- Fruit acids in high concentration and low pH level are used for chemical peelings. Caution is recommended, though: in the case of frequent and long-term treatment the incidence for rosacea and perioral dermatitis is increasing.

Maintaining the complexion

- Antioxidants are (preventively) used against hyperpigmentation. Liposomal vitamin C phosphate ($\leq 1\%$) effectively inhibits pigmentation during laser treatments. Among this group also are arbutin with chemically bound hydroquinone as well as various polyphenols.
- Kojic acid and liquorice extracts (containing glabridin) are considered as tyrosinase inhibitors.
- Tranexamic acid ($\leq 2\%$) stabilises the superficial blood vessels (rosacea, erythema) and inhibits the melanin formation. Combined with niacinamide it is used against post-inflammatory hyperpigmentation (PIH).

- Kinetin (N-furfuryladenine), lipoic acid, resveratrol, curcumin and flavanoids (hydrogenated flavonoids) are supposed to belong to the AGE inhibitors (AGE = Advanced Glycation Endproducts) of different efficacy.

Problem skin

- Barrier disorders and atopic skin: evening primrose oil in the form of a nanodispersion in the case of delta-6-desaturase-enzyme defects, ceramides and phosphatidylcholine (see protection), aloe vera extracts (dry skin)
- Cracked skin: astringent witch hazel and horsetail extracts, green tea and epigallocatechin gallate (EGCG)
- Irritated skin: niacinamide, D-panthenol, aloe vera
- Anti-itching substances: urea, allantoin as well as further amides of long-chained fatty acids and of the anthranilic acid
- Acne: liposomal azelaic acid up to 1%, boswellic acids (protease inhibitors), retinol, niacinamide, native liposomal phosphatidylcholine, salicylic acid (antimicrobial), nanodisperse essential fatty acids in the form of kiwi seed oil, linseed oil, evening primrose oil and rose hip seed oil, zinc salts
- Inflammation-prone skin: essential fatty acids (see above), D-panthenol, boswellic acids, aloe vera, α -bisabolol (chamomile), rosmarinic acid, phosphatidylserine (macrophage-activating)
- Psoriasis: sphingosine-1-phosphate (inhibition of the keratinocyte proliferation), liposomal fumaric acid, essential fatty acids (see above)
- Rosacea and perioral dermatitis: azelaic acid up to 1%, boswellic acids, tranexamic acid, echinacea (alias purple coneflower) and butcher's broom extracts, betulinic acid and essential fatty acids
- Stretch marks: nanodispersions with vitamin E acetate and essential fatty acids (see above)
- Scars: vitamins A, C and E; also refer to medical needling
- Antimicrobial substances: azelaic acid, salicylic acid, rosmarinic acid, betulinic acid
- Medical Needling: AMP boosters (e.g. polyhexanide) for germ reduction; lamellar vitamin preparations before and after the treatment

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